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On the taxonomy of certain taxa of the genus *Lethe* Hübner described by Rudolf Emil Mell (Lepidoptera, Papilionoidea, Nymphalidae, Satyrinae), with notes on related ones

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Abstract: The knowledge on certain taxa of the genus *Lethe* is updated. The syntype series of *Lethe camilla rufa* Mell, 1938 were examined and this taxon was found to be what known nowadays as *L. guansia* Sugiyama, 1999. Therefore the taxon *rufa* Mell, 1938 is raised to species rank and a new junior synonym is purposed: *Lethe rufa* Mell, 1938 **stat. nov.** (= *L. guansia* Sugiyama, 1999 **syn. nov.**). *Lethe bipupilla* Chou & Zhao, 1994 is resurrected from the synonym of *L. trimacula* and treated as a bona subspecies, viz. *L. trimacula bipupilla* **stat. nov.** Two taxa, *Lethe trimacula pekiangensis* Mell, 1935 and *L. trimacula kuatunensis* Mell, 1942 are confirmed to be junior synonyms of *L. trimacula trimacula*. Lectotype has been designated for *Lethe camilla rufa* Mell, 1938. Adults and male genitalia of the aforementioned taxa and related ones are illustrated.

Keywords: Fujian, Guangdong, Hubei, Lethina, Satyrini, Sichuan

关于鲁道夫·埃米尔·迈尔描述的部分黛眼蝶分类单元的分类学研究及其相关者之注记（鳞翅目，凤蝶总科，蛱蝶科，眼蝶亚科）

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摘要：分类单元 *Lethe camilla rufa* Mell, 1938 的群模标本被检视，证实其实为广西黛眼蝶 *L. guansia* Sugiyama, 1999 之首异名，故将其提升为独立种，即红黛眼蝶 *L. rufa* Mell, 1938 **stat. nov.**，并将 *L. guansia* Sugiyama, 1999 处理为其次异名（**syn. nov.**）。舜目黛眼蝶 *Lethe bipupilla* Chou & Zhao, 1994 被证实为重瞳黛眼蝶 *L. trimacula* Leech, 1890 的有效亚种，故将其从重瞳黛眼蝶次异名中恢复，即重瞳黛眼蝶舜目亚种 *L. trimacula bipupilla* **stat. nov.** 迈尔描述的重瞳黛眼蝶二亚种，即北江亚种 *Lethe trimacula pekiangensis* Mell, 1935 及挂墩亚种 *L. trimacula kuatunensis* Mell, 1942 被证实为指名亚种之次异名。本文亦对分类单元 *Lethe camilla rufa* Mell, 1938 的选模作出指定。

关键词：福建，广东，湖北，黛眼蝶亚族，眼蝶族，四川

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Introduction

Rudolf Emil Mell (1878–1970) was a German zoologist and entomologist mainly focusing on the southern and southwestern Chinese fauna. He arrived at Guangzhou (know as Canton at his time) in 1908 and during his staying in Guangdong, he travelled to many parts of the province to collect Lepidoptera. After returning to Germany in 1921, Mell described many new Chinese butterfly taxa based on the rich material from his own collection and from the collection of Hermann Höne (1883–1963). However, most of the taxa described by him were not illustrated in the original description nor examined by modern researchers, which limited our understanding of the butterfly fauna in southern and southwestern China. Therefore it is necessary to elucidate the taxa described by Mell in order to clarify taxonomic issues and maintain the nomenclatural stability. In the present study, the author mainly deals with the taxonomic issues surrounding three *Lethe* taxa described by Mell, namely *Lethe camilla rufa* Mell, 1938, *L. trimacula pekiangensis* Mell, 1935 and *L. trimacula kuatunensis* Mell, 1942.

Material and Methods

Specimens examined in this study are deposited in the following institute and collection: the Chongqing Museum of Natural History, Beibei, Chongqing, China (CQMNH); the Natural History Museum (NHMUK), London, UK; the Leibniz Institute for the Analysis of Biodiversity Change, Zoological Research Museum Alexander Koenig (former Zoologisches Forschungsmuseum Alexander Koenig, ZFMK), Bonn, Germany, the Natural History Museum Berlin (Museum für Naturkunde, MfN), Berlin, Germany, the Muséum national d'Histoire naturelle (MNHN), Paris, France, the South China Agricultural University (SCAU), Guangzhou, China; the Entomological collection of Sun Yat-sen University (CSYSU), Guangzhou, China; the Hunan Agricultural University (HUNAU), Changsha, China; Northwest Agriculture and Forestry University (NWAFU), Yangling, China; the research collection of Song-yun Lang (CLSY), Chongqing, China; the research collection of Hao Huang (CHH), Qingdao, China and the research collection of Hitoshi Sugiyama (CHS), Gifu, Japan. Abdomens were removed and macerated in hot 10% KOH solution for examination of male genitalia. Photos of genitalia were taken under a Keyence VHX-2000 or a Keyence VHX-7000 digital microscope. Adult and genitalia photos were all processed by Adobe Photoshop CS5 ® software. Terminology of adult and genitalia follows Bozano (1999) and Lang (2017). Abbreviations: HT = Holotype; LT = Lectotype; PLT = Paralectotype; ST = Syntype; gen. prep. No. = genitalia preparation number.

Label data. For the holotype/lectotype label citations, information provided in quotation marks is transcribed verbatim. Different labels are separated by a forward slash ("/") while the different lines of the same label are separated by a vertical bar ("|"). Any additional data are provided in square brackets. The content of the labels of additional specimens examined including paratypes is edited/translated in accordance with English grammar and standardized.

Results

Lethe rufa Mell, 1938 stat. nov. 红黛眼蝶

Figs 2–6

Lethe camilla rufa Mell, 1938: 139; Huang 2019: 208.

Lethe guansia Sugiyama, 1999: 1, Figs 1, 2 & 25; Lang 2017: 86, pl. IX, figs 3 & 4; Lang 2020: 325, figs 1, 17 & 20a. **syn. nov.**

Type material examined. Lectotype (designated herein): male, printed purple label "Kuatun (2300m), 27.40n, Br. | 117. 40ö. L. J. Klapperich | 23. 5. 1938 (Fukien)" / printed red label "Lectotypus" / printed tracing paper label "23 MAY 1938" / printed label with unique QR-code "MfN URI | http://coll.mfn- | berlin.de/u/09f219" (MfN). **Paralectotype:** 1 male, same locality and collector as in lectotype, but 23. V. 1938 (MfN); 1 male, same locality and collector as in lectotype, but

19. V. 1938 (MfN); 1 male, same locality and collector as in lectotype, but 18. V. 1938 (MfN); 1 female, same locality and collector as in lectotype, but 8. VI. 1938 (MfN); 1 male, same locality and collector as in lectotype, but 12. V. 1938 (ZFMK); 2 males, same locality and collector as in lectotype, but 16. V. 1938 (ZFMK); 3 males, same locality and collector as in lectotype, but 19. V. 1938 (ZFMK); 4 males, same locality and collector as in lectotype, but 24. V. 1938 (ZFMK); 1 male, same locality and collector as in lectotype, but 26. V. 1938 (ZFMK); 1 male, same locality and collector as in lectotype, but 31. V. 1938 (ZFMK); 1 male, same locality and collector as in lectotype, but 3. VI. 1938 (ZFMK); 1 female, same locality and collector as in lectotype, but 26. V. 1938 (ZFMK).

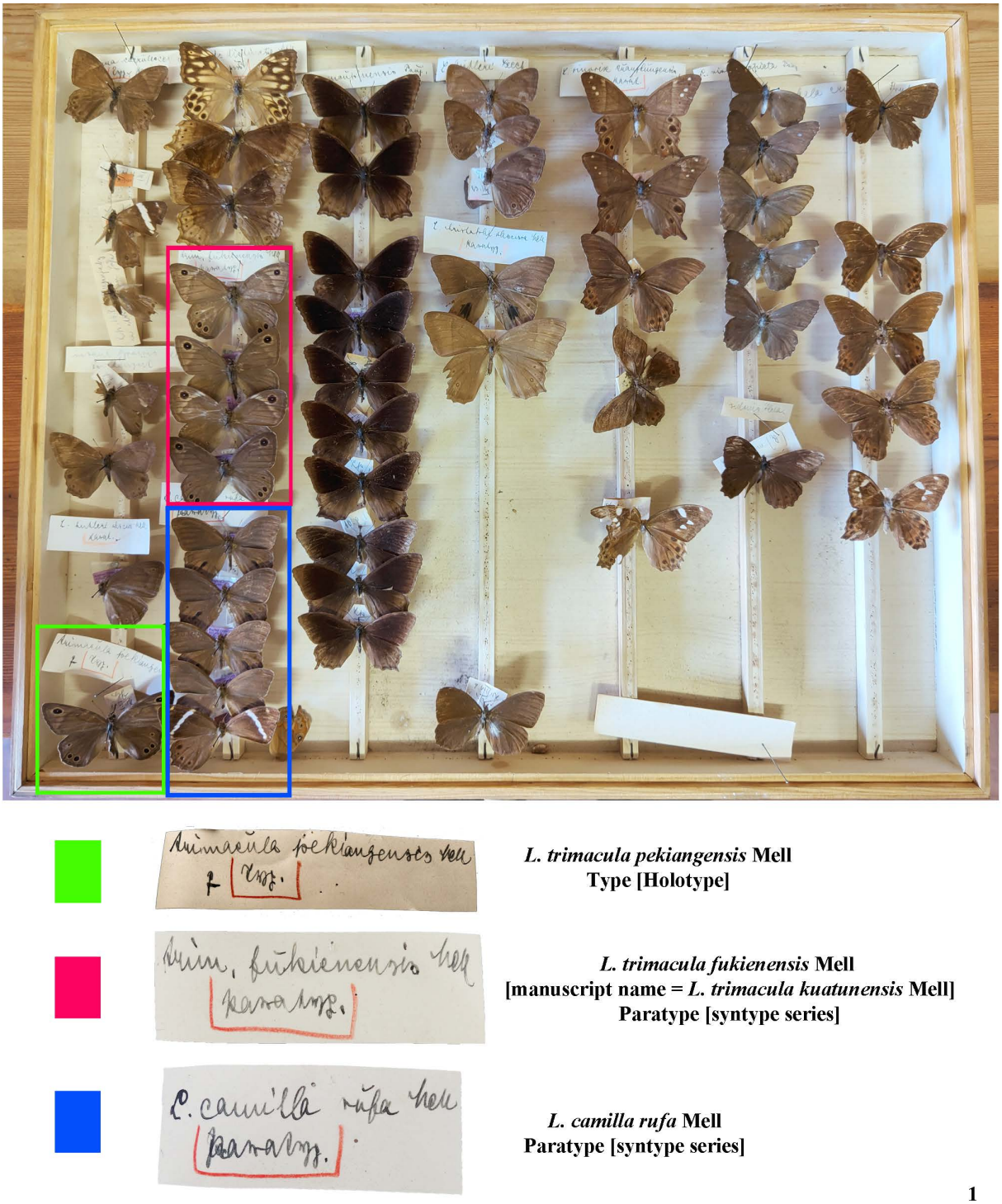
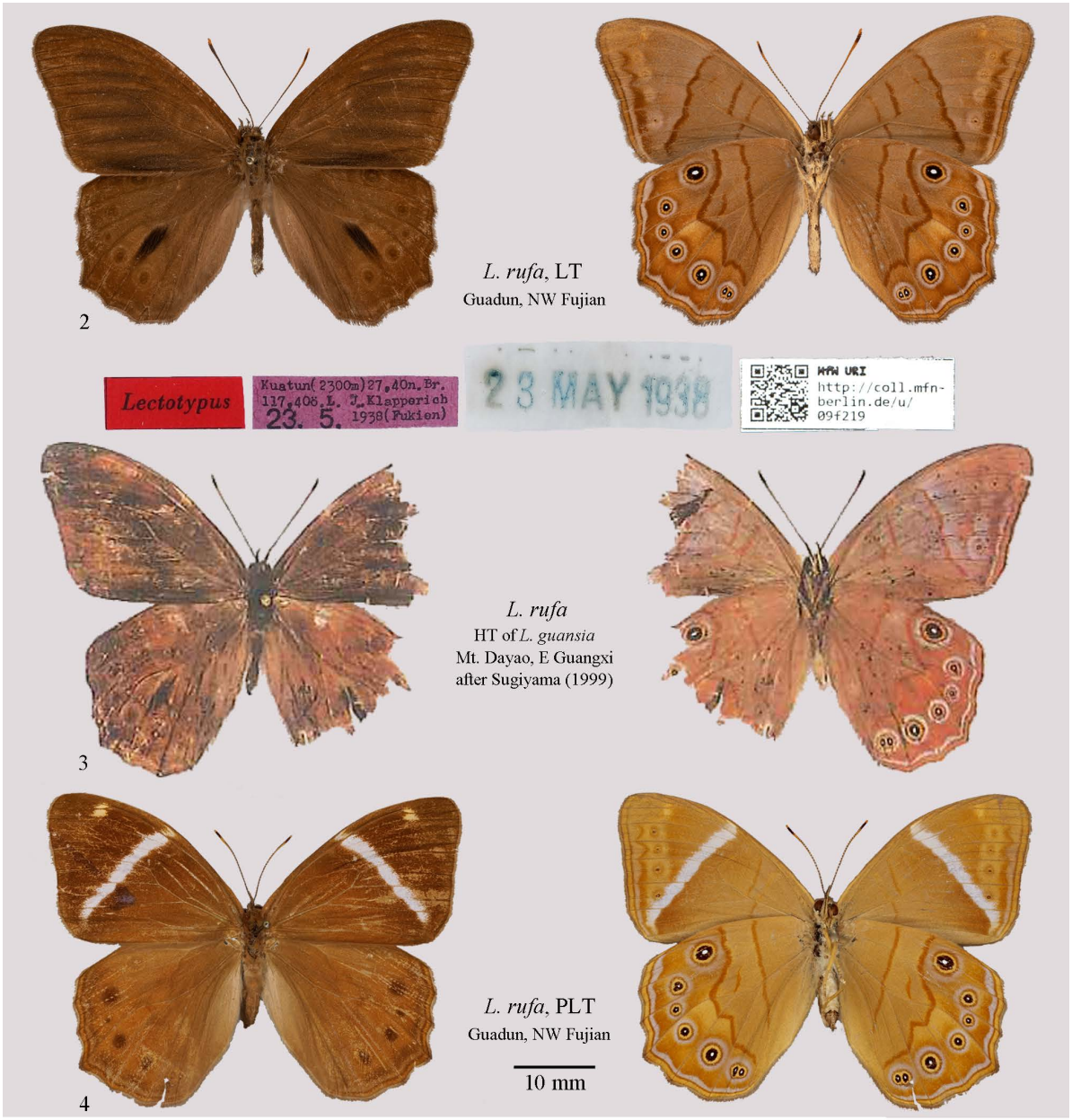


FIGURE 1. Unsorted drawer containing *Lethe* specimens from former Mell collection held in MfN. The type series of the taxa involved in the present study are marked out with different colors.



FIGURES 2–6. Adults and male genitalia of *Lethe rufa* **stat. nov.** Depository of the specimens: 2 & 5 in MfN, 3 & 6 in CHS, 4 in ZFMK. **a** = genitalia capsule with left valva removed **b** = lateral view of the phallus **c** = dorsal view of the phallus **d** = dorsal view of the tip of left valva. Scale bar in genitalia figures applies only to fig. 5.

Additional material examined: 1 male, 3. IX. 1937, Kwangtseh-Fukien [Guangze, Fujian], J. Klapperich leg., ZFMK Lep177663 (ZFMK); 1 male, same locality and collector, but 1. VIII. 1937, ZFMK Lep177664 (ZFMK); 1 male, same locality and collector, 15. IX. 1937, ZFMK Lep177665 (ZFMK).

Remarks. 1) Taxon *rufa* was described based on 19 males and 3 females collected from Kuatun [=Guadun, located in the Wuyishan National Park], NW Fujian, and in the original description Mell (1938) did not designate a holotype, therefore the 22 specimens are all syntypes. Amount the 22 specimens, 19 of them can still be located, with four males and one female held in MfN and 13 males and one female held in ZFMK. In order to stabilized the nomenclature, a male from the syntype series held in MfN was designated here as the lectotype. **2)** This taxon has been assumed to be related to *L. camilla* or *L. privigna* Leech, 1892 by some authors, e.g. Lang (2017) and H. Huang (2019) due to misidentification, since in the exact same locality an undescribed taxon with *L. privigna*-appearance also occurs, and this taxon is usually identified as *L. camilla rufa*. During the visit of the author to MfN in 2023, part of the syntype series of *L. camilla rufa* were discovered in the unsorted satyrid collection of Mell along with the holotype of *Lethe trimacula pekiangensis* Mell, 1935 and part of the syntypes of *Lethe trimacula kuatunensis* Mell, 1942 (Fig. 1), well labelled with the following handwritten identification "*L. camilla rufa* Mell | paratyp.". After examining the adults and male genitalia, it turns out that this taxon is actually what widely known as *L. guansia* Sugiyama, 1999, a distinct species closely related to *L. latiaris* (Hewitson, 1863). Since the name *rufa* clearly has the priority, the following taxonomic treatment is proposed: *L. rufa* Mell, 1938 **stat. nov**. = *L. guansia* Sugiyama, 1999 **syn. nov.** It is also worth noting that the three males of the second generation mentioned in Mell (1942) from Guangze, NW Fujian are found mixed together with the paralectotypes in the collection of ZFMK, and under one specimen with institutional number ZFMK Lep177663, a handwritten label with the identification "*L. camilla rufa* Mell" is also found.

Distribution. NW Fujian, N Guangdong & E Guangxi.

Lethe trimacula trimacula Leech, 1890 重瞳黛眼蝶指名亚种

Figs. 7–17, 22–32, 37–42, 46–52 & 58–64

Lethe trimacula Leech, 1890: 27; Chou 1994: 341; Wu 2017: 485, figs 5–7; Koiwaya 1998: 12, fig. 3.

Lethe trimacula pekiangensis Mell, 1935: 37.

Lethe trimacula kuatunensis Mell, 1942: 277.

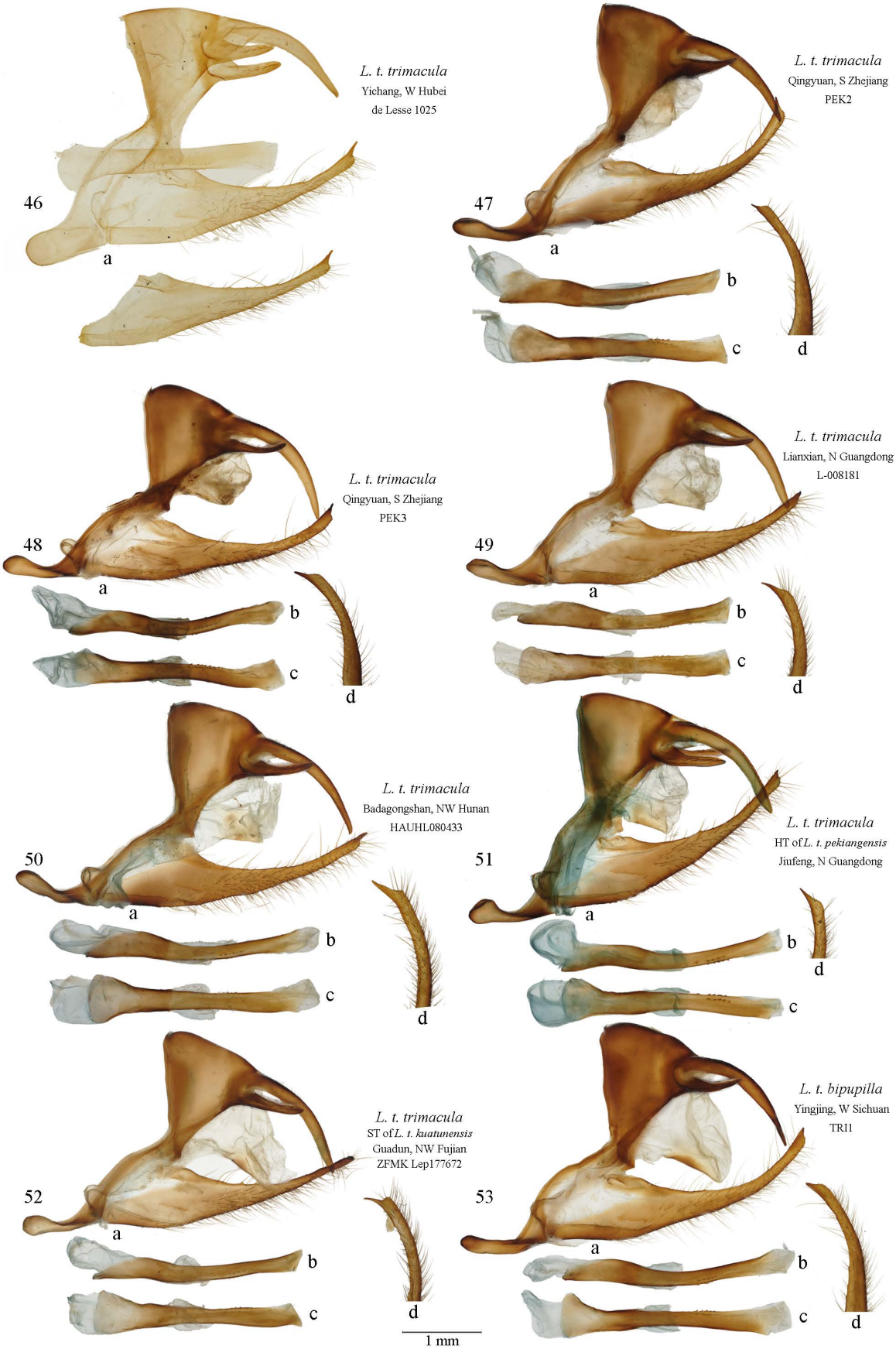
Material examined. Possible syntype: 5 males, printed label "Chang Yang | A.E. Pratt Coll | July 1888" / printed label "Rothschild | Bequest | B.M.1939-1" / printed labels with unique QR-codes "NHMUK015106361" / "NHMUK015106362" / "NHMUK015106363" / "NHMUK015106364" / "NHMUK015106365" (NHMUK); **Holotype** of *L. trimacula pekiangensis*: male, handwritten label "Gf [Gaofung (=Jiufeng)] | 11.VI.18" / handwritten label "*trimacula pekiangensis* Mell | Typ." / printed label with unique QR-code "MfN URI | http://coll.mfn- | berlin.de/u/09f30f" (MfN); **Syntype** series of *L. trimacula kuatunensis*: 2 males, Kuatun (2300m), L. J. Klapperich leg., 10. VI. 1938 (1 male in ZFMK, 1 male in MfN); 1 male, same locality and collector, but 8. VI. 1938 (MfN); 4 males, same locality and collector, but 12. VI. 1938 (3 males in ZFMK, 1 male in MfN), gen. prep. No. ZFMK Lep177672; 1 male, same locality and collector, but 13. VI. 1938 (ZFMK); 1 male, same locality and collector, but 16. VI. 1938 (ZFMK); 1 male, 1 female, same locality and collector, but 17. VI. 1938 (male in ZFMK, female in MfN); 1 male, same locality and collector, but 18. VI. 1938 (ZFMK); 2 males, same locality and collector, but 19. VI. 1938 (ZFMK).

Additional material examined. 1 male, Chang Yang, A.E. Pratt leg., June 1888, NHMUK015106366 (NHMUK); 1 female, Chang Yang, A.E. Pratt leg., June 1888, NHMUK015106359 (NHMUK); 1 female, Chang Yang, 6000 ft, Native collector, 1889, NHMUK015106360 (NHMUK); 1 female, Chang Yang, 6000 ft, Native collector, 1889, NHMUK015930008 (NHMUK); 1 male, Wychang (Yichang), slide No. de Lesse 1025 (MNHN); 4 males, 11–20. V. 2019, Qingyuan, Zhejiang, native collector leg., gen. prep. No. PEK1 & PEK2 (SCAU); 3 males, 1 female, same locality, but 10–20. VI. 2019, Qing-song Wu leg., gen. prep. No. PEK3 (SCAU); 1 male, 28. VI. – 27. VII. 2020, Badagongshan,

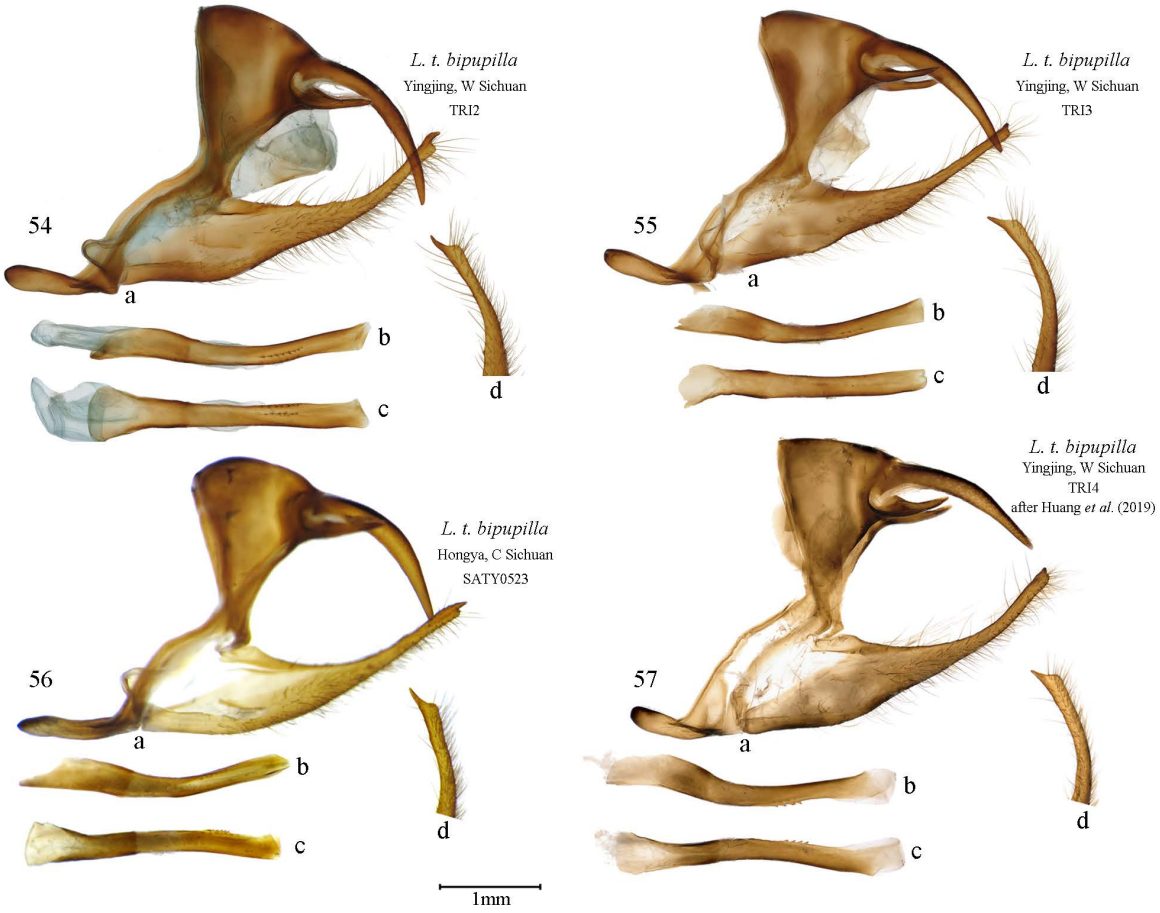
FIGURES 7–21. Males of *Lethe trimacula* sspp., upperside. Depository of the specimens: 7 & 8 in NHMUK (©The Trustees of NHMUK); 9 in MNHN; 10, 11, 18–20 in SCAU; 12 & 13 in CSYSU; 14 in HUNAU; 15 in CQMNH; 16 in MfN, 17 in ZFMK; 21 in CLSY.

FIGURES 22–36. Underside of figs 7–21.

FIGURES 37–45. Females of *Lethe trimacula* sspp. Depository of the specimens: 37–39, 44 in NHMUK (©The Trustees of NHMUK); 40 in CSYSU; 41 in CQMNH; 42 in MfN; 43 in NWAFU; 45 in CHH. Scale bar applies to all but fig. 43.



FIGURES 46–53. Male genitalia of *Lethe trimacula* sspp. Depository of the genitalia preparation: 46 in MNHN; 47, 48 & 53 in SCAU; 49 in CSYSU; 50 in HUNAU; 51 in MfN; 52 in ZFMK. a=genitalia capsule with left valva removed; b=lateral view of the phallus; c=dorsal view of the phallus; d=dorsal view of the tip of left valva.



FIGURES 54–57. Male genitalia of *Lethe trimacula bipupilla* **stat. nov.** Depository of the genitalia preparation: 54, 55 & 57 in SCAU; 56 in CLSY. **a** = genitalia capsule with left valva removed; **b** = lateral view of the phallus; **c** = dorsal view of the phallus; **d** = dorsal view of the tip of left valva.

Hunan, Cheng-qing Liao & Min Deng leg., gen. prep. No. HAUHL080433 (HUNAU); 1 male, 2. VI. 1998, Dadongshan, Lianxian, Guangdong, Zheng-shuo Chen leg., gen. prep. No. L-008181 (CSYSU); 1 male, same locality, but 9. VI. 2001, Wei-cai Xie leg., gen. prep. No. L-008203 (CSYSU); 1 female, 6. VI. 1974, Tianjingshan, Ruyuan, Guangdong, Zheng-shuo Chen leg. (CSYSU); 1 male, 2 females, Simianshan, Chongqing, He-li Deng leg. (CQMNH).

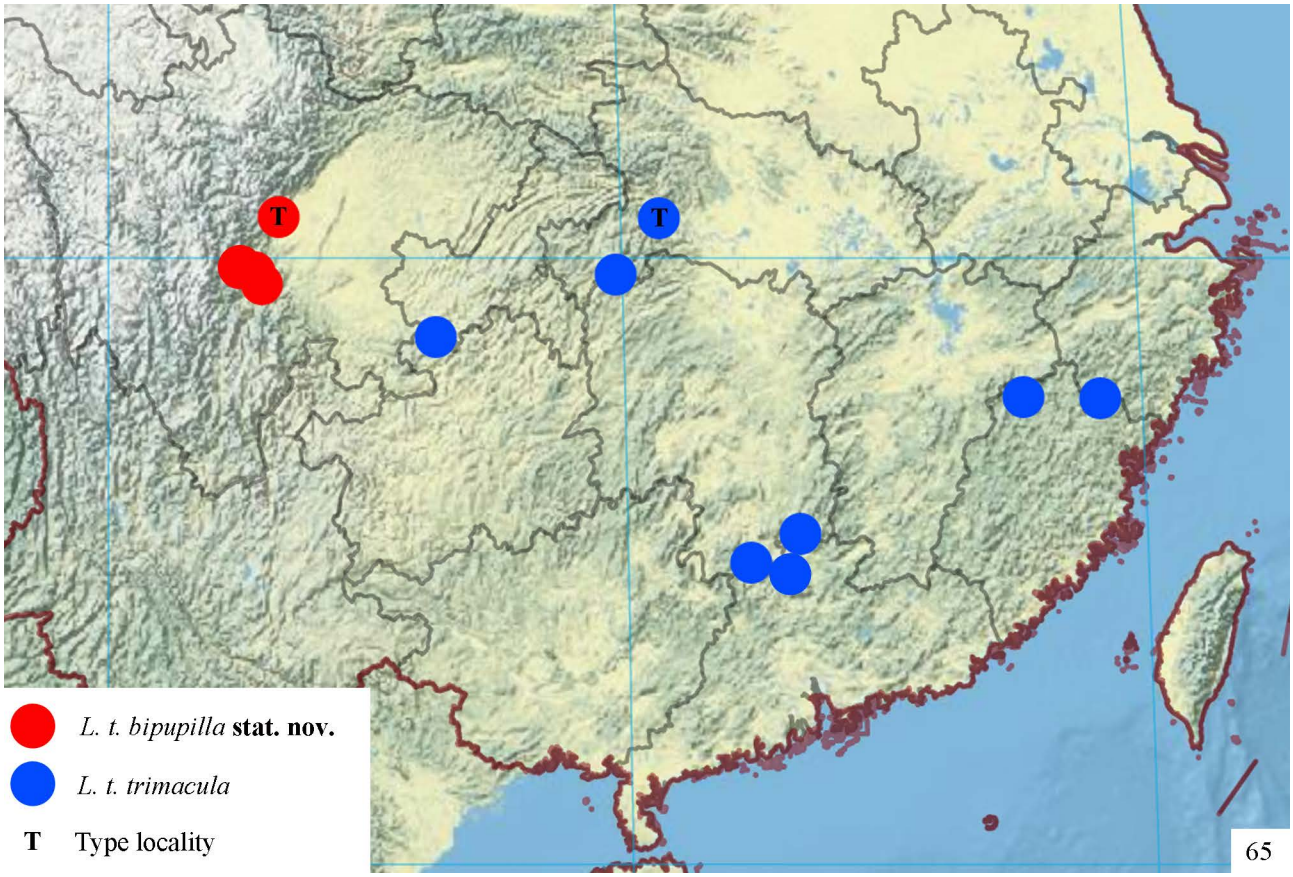
Remarks. 1) In the original description, Leech (1890) stated in the front "THE following are the descriptions of some of the more important of the new species captured by Mr. Pratt, who collected for me in the neighbourhood of Ichang, Central China, during the season of 1888….", and in the section of the description of *L. trimacula*, the examined specimens were stated as "Several males and one female from Chang Yang, taken in July.". South (1902), in the catalogue of Leech's collection of palaearctic butterflies, recorded only two females marked with letters "a" and "b" and the specimen marked with letter "a" was stated as the "type" (equivalent to syntype actually). In the collection of NHMUK, the author found two females bearing syntype labels, and the one marked with letter "a" bears also a round, red "Type" label (Figs 37 & 58). However this specimen was collected in June, as clearly stated in the label (Fig. 58), therefore it does not belong to the syntype series. The female specimen marked with letter "b" was not found, but instead a female marked with letter "c" was found bearing syntype label (Figs 38 & 59). However this female is definitely not a syntype as it was collected in 1889. A third female, not marked with any letter, from Changyang (Figs 39 & 62) also does not agree with the information given by Leech (1890). Therefore, it is possible that the female syntype examined by Leech (1890) is lost, or Leech (1890) just simply gave a wrong collecting date for the female with letter "a". Beside these females, several males bearing printed label "Chang Yang | A.E. Pratt Coll | July 1888" are found in the collection of NHMUK, belonging to the former Rothschild collection (Figs 7, 8,

FIGURES 58–64. Labels of the *Lethe trimacula trimacula* specimens illustrated.

22, 23, 60 & 61). They are possibly the "several males" examined by Leech (1890), but it is unknown if Rothschild once acquired part of Leech's palaearctic butterfly collection, since under these specimens no label indicates they once belonged to Leech collection, like in the two females (Figs 58 & 59). Hence the problem of the true syntype series of *L. trimacula* can only be solved when more evidences are revealed. **2)** In the original description, Mell (1935) stated the holotype of *Lethe trimacula pekiangensis* Mell, 1935 (holotype status fixed by monotypy) was collected on 11. VI. 1917. However, the only specimen of this taxon held in MfN was collected on 11. VI. 1918 (Fig. 63). Nevertheless, the author believes that the specimen is still the holotype of the taxon, and such difference is due to either typo made at that time or simply the wrong date written on the label, since the specimen itself agrees well with the description in Mell (1935). **3)** Lang (2017), although treated *L. trimacula pekiangensis* Mell, 1935 and *Lethe trimacula kuatunensis* Mell, 1942 as synonyms of *L. trimacula*, stated that the status of the two taxa is still uncertain without examining the type series. In the present study, the author managed to examine and dissect the holotype of *L. trimacula pekiangensis* Mell, 1935 (Figs 16, 31, 51 & 63) as well as a male syntype of *Lethe trimacula*

kuatunensis Mell, 1942 (Figs 17, 32, 52 & 64), and examined several specimens of both sexes from the syntype series of *Lethe trimacula kuatunensis*. As a result, the author found that the wing patterns as well as the male genitalia structures of these two taxa display no constant and fundamental difference from those of other populations of *Lethe trimacula trimacula*. Hence the taxonomic treatment in Lang (2017) is correct.

Distribution. W Hubei, Chongqing, N Guangdong, NW Hunan, S Zhejiang & NW Fujian (Fig. 65).



FIGURES 65. Distribution map of *Lethe trimacula* sspp. in the present study.

Lethe trimacula bipupilla Chou & Zhao, 1994 stat. nov. 重瞳黛眼蝶舜目亚种

Figs. 18–21, 33–36, 43–45, 53–57

Lethe bipupilla Chou & Zhao *In* Chou 1994 (ed.): 341, fig. 3 & 755, fig. 17.

Lethe trimacula: Koiwaya 1998: 14, figs 12–16; Lang 2017: pl. 11, fig. 126 & pl. XI, fig. 14; Huang *et al*. 2019: figs. 11, 12 & 19.

Material examined. 1 male, Ta Tong Kiao [possible Datongqiao, Ya'an] 1894, ex. Oberthür coll., NHMUK015106358 (NHMUK); 1 female, Siaolou [Lianglu, Tianquan] 1893, ex. Oberthür coll., NHMUK015106357 (NHMUK); 1 female, 3. VIII. 2014, Longcanggou, Yingjing, W Sichuan, Si-yao Huang leg. (CHH); 1 male, same locality, but 20. VI. 2016, gen. prep. No. TRI1 (SCAU); 2 males, same locality, but 2. VII. 2021, Xiao-ling Fan, Si-yao Huang, Yong-xiang Hou & Li-juan Zhu leg., gen. prep. No. TRI2 & TRI3 (SCAU); 1 male, same locality, but 20. VII. 2018, gen. prep. No. TRI4 (SCAU); 2 males, 4–7. VII. 2011, Hongya, Sichuan, Song-yun Lang leg., gen. prep. No. SATY0060 & SATY0523 (CLSY).

Diagnosis. Superficially *L. trimacula bipupilla* can be distinguished from *L. trimacula trimacula* by the combination of the following characters: 1) on forewing underside in males, the dark postmedial band is concave in space 3 and generally wavier and more zigzag; 2) on hindwing underside in females, the vein 7 is more strongly suffused with yellow scales in the large subapical ocellus occupying spaces 6 and 7, which dividing the large bipupillate ocellus into two smaller, unipupillate ones and 3) the ocellus in space 4 on hindwing underside is better-

developed and larger in females, while in the latter the ocellus is smaller and sometimes even absent. The male genitalia of these two taxa display no constant difference.

Remarks. 1) Taxon *bipupilla* was originally described as a distinct species based on a single female collected from Dayi, Sichuan. Koiwaya (1998) pointed out that the holotype is merely a female of *L. trimacula* and synonymized *L. bipupilla* with *L. trimacula*, and this treatment was followed by most of the subsequent researchers. However, during the author's studies on the *Lethe* taxa related to those described by Mell, the population from Sichuan examined by the author is found to possess some subtle but rather constant characters differing from those distributed in the central, east and south China, as summarized above, and the name *bipupilla* should be applied to it. Therefore the taxon *bipupilla* is restored from the synonym of *L. trimacula* and treated as a bona subspecies of *L. trimacula*, viz. *L. trimacula bipupilla* **stat. nov. 2)** It should be noted that Koiwaya (1998) illustrated a male from Tongren, E Guizhou and this male is superficially identical to *L. trimacula bipupilla*, indicating a possible overlapping distribution of both subspecies. In such case, the taxon *bipupilla* should probably be treated as a distinct species. However such assumption can only be clarified based on specimens with reliable collecting data via molecular approaches or ecological evidences, pending future studies. Moreover, it is also a possibility that the individual of *L. trimacula bipupilla* from Tongren, E Guizhou is merely mislabeled, since no further record of this taxon is known from Tongren or other parts Guizhou province except for this one. Therefore, in the current study Guizhou is excluded from the distribution range of *L. trimacula bipupilla*.

Distribution. W Sichuan (Fig. 65).

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